

1 CLAIMS

2 What is claimed is:

- 3 1. A method for fabricating a fiber-optic waveguide, comprising the step of spatially
4 selectively removing material from a cladding layer of an evanescent waveguide fiber
5 segment of a waveguide optical fiber and forming an evanescent optical coupling portion of
6 a cladding layer surface thereof, so that a remaining portion of the cladding layer is
7 asymmetrically disposed about at least a portion of a core of the waveguide optical fiber,
8 thereby enabling an evanescent portion of a propagating optical mode propagating
9 therethrough to extend transversely beyond at least a portion of the coupling portion of the
10 cladding layer surface of the evanescent waveguide fiber segment while being substantially
11 transversely encompassed by respective cladding layers of two longitudinally adjacent fiber
12 segments of the waveguide optical fiber.
- 13 2. A method for fabricating a fiber-optic waveguide as recited in Claim 1, wherein the
14 cladding-material-removing step comprises spatially-selective etching of material from the
15 cladding layer of the evanescent waveguide fiber segment of the waveguide optical fiber.
- 16 3. A method for fabricating a fiber-optic waveguide as recited in Claim 2, wherein the
17 cladding-material-removing step comprises the steps of:
18 providing the waveguide optical fiber with a mask that substantially covers the two
19 longitudinally adjacent segments of the waveguide optical fiber but covers only portions
20 of a length and a circumference of the evanescent waveguide fiber segment of the
21 waveguide optical fiber; and
22 spatially-selectively etching the waveguide optical fiber, thereby asymmetrically removing
23 material from the cladding layer of the evanescent waveguide fiber segment of the
24 waveguide optical fiber.
- 25 4. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the mask-
26 providing step comprises spatially-selective removal of an outer fiber coating from portions
27 of the length and circumference of the evanescent waveguide fiber segment and the mask
28 comprises portions of the outer fiber coating remaining on the two longitudinally adjacent
29 segments of the waveguide optical fiber and on the evanescent waveguide fiber segment.

- 1 5. A method for fabricating a fiber-optic waveguide as recited in Claim 4, wherein the mask-
2 providing step comprises spatially-selective laser-machining of the outer fiber coating.
- 3 6. A method for fabricating a fiber-optic waveguide as recited in Claim 5, further comprising
4 the step of partially rotating the waveguide optical fiber during laser machining, thereby
5 removing mask material from arcuate portions of a surface of the waveguide optical fiber
6 extending partially around a circumference thereof.
- 7 7. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the
8 waveguide optical fiber rotates within a capillary tube during laser machining, thereby
9 providing substantially concentric rotation during laser machining.
- 10 8. A method for fabricating a fiber-optic waveguide as recited in Claim 5, further comprising
11 the steps of: rotating the waveguide optical fiber during laser machining, and modulating a
12 laser used for laser machining synchronously with rotation of the waveguide optical fiber,
13 thereby removing mask material from arcuate portions of a surface of the waveguide optical
14 fiber extending partially around a circumference thereof.
- 15 9. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the outer
16 fiber coating comprises a polymeric jacket and laser machining is performed with a UV-
17 emitting excimer laser.
- 18 10. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the outer
19 fiber coating comprises a carbon coating and laser machining is performed with a pulsed
20 laser.
- 21 11. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the outer
22 fiber coating comprises a carbon coating and laser machining is performed with a
23 substantially continuous laser.
- 24 12. A method for fabricating a fiber-optic waveguide as recited in Claim 5, wherein the outer
25 fiber coating comprises a photo-resist material.
- 26 13. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the mask-
27 providing step comprises spatially-selective deposition of an outer fiber coating on the two
28 longitudinally adjacent segments of the waveguide optical fiber and on portions of the length
29 and circumference of the evanescent waveguide fiber segment, and the mask comprises the
30 outer fiber coating thus deposited.

- 1 14. A method for fabricating a fiber-optic waveguide as recited in Claim 13, wherein the mask-
2 providing step comprises spatially-selective metal vapor deposition of the outer fiber
3 coating.
- 4 15. A method for fabricating a fiber-optic waveguide as recited in Claim 14, wherein shadow
5 masking techniques are employed to implement the spatially-selective metal vapor
6 deposition of the outer fiber coating.
- 7 16. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the
8 spatially-selective etching step is performed using aqueous hydrofluoric acid.
- 9 17. A method for fabricating a fiber-optic waveguide as recited in Claim 16, wherein the
10 aqueous hydrofluoric acid comprises between about 5% HF and about 50% HF buffered
11 with NH_4F .
- 12 18. A method for fabricating a fiber-optic waveguide as recited in Claim 17, wherein the
13 aqueous hydrofluoric acid comprises between about 7% HF and about 8% HF buffered with
14 between about 30% NH_4F and about 40% NH_4F .
- 15 19. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the
16 waveguide optical fiber is polarization-maintaining optical fiber, comprising longitudinally
17 extending stressor elements disposed within the cladding layer in substantially opposing
18 positions about the core, the stressor elements being etched at a slower rate than the cladding
19 layer, thereby yielding transversely protruding passive alignment structures as a result of the
20 cladding-material-removing step.
- 21 20. A method for fabricating a fiber-optic waveguide as recited in Claim 19, wherein the passive
22 alignment structures are adapted to engage longitudinally adjacent fiber segments of a fiber-
23 ring whispering-gallery-mode optical resonator, thereby enabling reproducible substantially
24 tangential engagement of the evanescent waveguide fiber segment and a fiber-ring
25 whispering-gallery-mode optical resonator and enabling reproducible evanescent optical
26 coupling between a whispering-gallery optical mode of the fiber-ring resonator and the
27 propagating optical mode of the evanescent waveguide fiber segment.
- 28 21. A method for fabricating a fiber-optic waveguide as recited in Claim 3, wherein the
29 cladding-material-removing step further comprises the step of removing the mask from the
30 waveguide optical fiber.

1 22. A method for fabricating a fiber-optic waveguide as recited in any of Claims 1 through 21,
2 wherein the cladding-material-removing step further comprises the step of controlling a
3 shape and size of the coupling portion of the cladding layer surface of the evanescent
4 waveguide fiber segment.

5 23. A method for fabricating a fiber-optic waveguide as recited in Claim 22, wherein:
6 the cladding-material-removing step comprises the steps of
7 providing the waveguide optical fiber with a mask that substantially covers the two
8 longitudinally adjacent segments of the waveguide optical fiber but covers only
9 portions of a length and a circumference of the evanescent waveguide fiber
10 segment of the waveguide optical fiber, and
11 spatially-selectively etching the waveguide optical fiber, thereby asymmetrically
12 removing material from the cladding layer of the evanescent waveguide fiber
13 segment of the waveguide optical fiber; and
14 the optical-coupling-portion-shape-and-size-controlling step comprises controlling a shape
15 and a size of an area of the evanescent waveguide fiber segment left uncovered by the
16 mask-providing step.

17 24. A method for fabricating a fiber-optic waveguide as recited in Claim 23, wherein a width
18 and a circumferential extent of the area of the evanescent waveguide fiber segment left
19 uncovered by the mask-providing step are controlled, thereby controlling the shape and size
20 of the coupling portion of the cladding layer surface of the evanescent waveguide fiber
21 segment.

22 25. A method for fabricating a fiber-optic waveguide as recited in Claim 23, wherein:
23 the area left uncovered by the mask-providing step comprises a plurality of arcuate segments
24 of the cladding layer surface, the arcuate segments extending partially around the
25 circumference of the waveguide optical fiber and being separated from adjacent arcuate
26 segments by intervening portions of the mask; and
27 number, widths, circumferential extents, and spacings from adjacent arcuate segments are
28 controlled for the plurality of arcuate segments, thereby controlling the shape and size
29 of the coupling portion of the cladding layer surface of the evanescent waveguide fiber
30 segment.

- 1 26. A method for fabricating a fiber-optic waveguide as recited in Claim 22, wherein the
2 coupling portion of the cladding layer surface of the evanescent waveguide fiber segment
3 has a saddle-like shape, having a concave longitudinal-sectional shape near at least a portion
4 of the core of the evanescent waveguide fiber segment and a convex transverse-sectional
5 shape near at least a portion of the core of the evanescent waveguide fiber segment.
- 6 27. A method for fabricating a fiber-optic waveguide as recited in Claim 26, wherein the
7 concave longitudinal-sectional shape of the coupling portion of the cladding layer surface is
8 adapted to receive and substantially tangentially engage a whispering-gallery-mode optical
9 resonator, and to enable evanescent optical coupling between a whispering-gallery optical
10 mode of the resonator and the propagating optical mode in the evanescent waveguide fiber
11 segment.
- 12 28. A method for fabricating a fiber-optic waveguide as recited in Claim 26, wherein the convex
13 transverse-sectional shape of the coupling portion of the cladding layer surface is adapted to
14 enable substantial tangential engagement of the coupling portion of the cladding layer
15 surface and a fiber-ring whispering-gallery-mode optical resonator, and to enable evanescent
16 optical coupling between a whispering-gallery optical mode of the fiber-ring resonator and
17 the propagating optical mode in the evanescent waveguide fiber segment.
- 18 29. A method for fabricating a fiber-optic waveguide as recited in Claim 22, wherein the
19 coupling portion of the cladding layer surface of the evanescent waveguide fiber segment
20 has a pit-like shape, having a concave longitudinal-sectional shape near at least a portion of
21 the core of the evanescent waveguide fiber segment and a concave transverse-sectional
22 shape near at least a portion of the core of the evanescent waveguide fiber segment.
- 23 30. A method for fabricating a fiber-optic waveguide as recited in Claim 29, wherein the
24 concave longitudinal-sectional shape of the coupling portion of the cladding layer surface is
25 adapted to receive and substantially tangentially engage a whispering-gallery-mode optical
26 resonator, and to enable evanescent optical coupling between a whispering-gallery optical
27 mode of the resonator and the propagating optical mode in the evanescent waveguide fiber
28 segment.
- 29 31. A method for fabricating a fiber-optic waveguide as recited in Claim 29, wherein the
30 concave transverse-sectional shape of the coupling portion of the cladding layer surface is

1 adapted to enable substantial tangential engagement of the coupling portion of the cladding
2 layer surface and a micro-disk whispering-gallery-mode optical resonator, and to enable
3 evanescent optical coupling between a whispering-gallery optical mode of the micro-disk
4 resonator and the propagating optical mode in the evanescent waveguide fiber segment.

5 32. A method for fabricating a fiber-optic waveguide as recited in Claim 22, wherein the
6 coupling portion of the cladding layer surface of the evanescent waveguide fiber segment
7 has a concave longitudinal-sectional shape near at least a portion of the core of the
8 evanescent waveguide fiber segment and a substantially flat transverse-sectional shape near
9 at least a portion of the core of the evanescent waveguide fiber segment, the concave
10 longitudinal-sectional shape of the coupling portion of the cladding layer surface being
11 adapted to receive and substantially tangentially engage a whispering-gallery-mode optical
12 resonator, and to enable evanescent optical coupling between a whispering-gallery optical
13 mode of the resonator and the propagating optical mode in the evanescent waveguide fiber
14 segment.

15 33. A method for fabricating a fiber-optic waveguide as recited in Claim 1, wherein the
16 cladding-material-removing step further comprises the step of controlling the amount of
17 cladding material removed from the evanescent wave fiber segment.

18 34. A method for fabricating a fiber-optic waveguide as recited in Claim 33, wherein the
19 controlling step comprises the steps of:
20 monitoring optical loss of the waveguide optical fiber during the cladding-material-
21 removing step; and
22 terminating the cladding-material-removing step in response to the optical loss of the
23 waveguide optical fiber reaching a pre-determined level.

24 35. A method for fabricating a fiber-optic waveguide as recited in Claim 34, wherein the pre-
25 determined optical loss level is between about 0.1 dB and about 30 dB.

26 36. A method for fabricating a fiber-optic waveguide as recited in Claim 34, wherein the pre-
27 determined optical loss level is between about 0.1 dB and about 10 dB.

28 37. A method for fabricating a fiber-optic waveguide as recited in Claim 34, wherein the pre-
29 determined optical loss level is between about 0.1 dB and about 3 dB.

- 1 38. A method for fabricating a fiber-optic waveguide as recited in Claim 34, wherein the pre-
2 determined optical loss level is between about 0.1 dB and about 1 dB.
- 3 39. A method for fabricating a fiber-optic waveguide as recited in Claim 33, wherein a
4 minimum distance between the core of the waveguide optical fiber and the coupling portion
5 of the cladding layer surface is between about 0 μm and about 10 μm as a result of the
6 cladding-material-removing step.
- 7 40. A method for fabricating a fiber-optic waveguide as recited in Claim 33, wherein the core of
8 the waveguide optical fiber is partially exposed as a result of the cladding-material-
9 removing step.
- 10 41. A fiber-optic waveguide fabricated by the method of any of Claims 1 through 40.
- 11 42. A fiber-optic waveguide, comprising:
12 an evanescent waveguide fiber segment comprising a core and a cladding layer;
13 a first longitudinally adjacent fiber segment comprising a core and a cladding layer, the
14 cladding layer substantially surrounding the core and substantially transversely
15 encompassing a propagating optical mode propagating through the first adjacent fiber
16 segment; and
17 a second longitudinally adjacent fiber segment comprising a core and a cladding layer, the
18 cladding layer substantially surrounding the core and substantially transversely
19 encompassing a propagating optical mode propagating through the second adjacent
20 fiber segment,
21 wherein:
22 the first adjacent fiber segment is joined at an end thereof to a first end of the evanescent
23 waveguide fiber segment and the second adjacent fiber segment is joined at an end
24 thereof to a second end of the evanescent waveguide fiber segment;
25 the core of the first adjacent fiber segment, the core of the evanescent waveguide fiber
26 segment, and the core of the second adjacent fiber segment form a substantially
27 continuous core of the fiber-optic waveguide, thereby enabling a propagating optical
28 mode to propagate therethrough; and
29 the cladding layer of the evanescent waveguide fiber segment is asymmetrically disposed
30 about at least a portion of the core thereof, thereby yielding a coupling portion of a
31 cladding layer surface of the evanescent waveguide fiber segment and enabling an

1 evanescent portion of the propagating optical mode to extend transversely beyond at
2 least a portion of the coupling portion of the cladding layer surface of the evanescent
3 waveguide fiber segment.

4 43. A fiber-optic waveguide as recited in Claim 42, wherein the coupling portion of the cladding
5 layer surface of the evanescent waveguide fiber segment has a saddle-like shape, having a
6 concave longitudinal-sectional shape near at least a portion of the core of the evanescent
7 waveguide fiber segment and a convex transverse-sectional shape near at least a portion of
8 the core of the evanescent waveguide fiber segment.

9 44. A fiber-optic waveguide as recited in Claim 43, wherein the concave longitudinal-sectional
10 shape of the coupling portion of the cladding layer surface is adapted to receive and
11 substantially tangentially engage a whispering-gallery-mode optical resonator, and to enable
12 evanescent optical coupling between a whispering-gallery optical mode of the resonator and
13 the propagating optical mode in the evanescent waveguide fiber segment.

14 45. A fiber-optic waveguide as recited in Claim 43, wherein the convex transverse-sectional
15 shape of the coupling portion of the cladding layer surface is adapted to enable substantial
16 tangential engagement of the coupling portion of the cladding layer surface and a fiber-ring
17 whispering-gallery-mode optical resonator, and to enable evanescent optical coupling
18 between a whispering-gallery optical mode of the fiber-ring resonator and the propagating
19 optical mode in the evanescent waveguide fiber segment.

20 46. A fiber-optic waveguide as recited in Claim 42, wherein the coupling portion of the cladding
21 layer surface of the evanescent waveguide fiber segment has a pit-like shape, having a
22 concave longitudinal-sectional shape near at least a portion of the core of the evanescent
23 waveguide fiber segment and a concave transverse-sectional shape near at least a portion of
24 the core of the evanescent waveguide fiber segment.

25 47. A fiber-optic waveguide as recited in Claim 46, wherein the concave longitudinal-sectional
26 shape of the coupling portion of the cladding layer surface is adapted to receive and
27 substantially tangentially engage a whispering-gallery-mode optical resonator, and to enable
28 evanescent optical coupling between a whispering-gallery optical mode of the resonator and
29 the propagating optical mode in the evanescent waveguide fiber segment.

- 1 48. A fiber-optic waveguide as recited in Claim 46, wherein the concave transverse-sectional
2 shape of the coupling portion of the cladding layer surface is adapted to enable substantial
3 tangential engagement of the coupling portion of the cladding layer surface and a micro-disk
4 whispering-gallery-mode optical resonator, and to enable evanescent optical coupling
5 between a whispering-gallery optical mode of the micro-disk resonator and the propagating
6 optical mode in the evanescent waveguide fiber segment.
- 7 49. A fiber-optic waveguide as recited in Claim 42, wherein the coupling portion of the cladding
8 layer surface of the evanescent waveguide fiber segment has a concave longitudinal-
9 sectional shape near at least a portion of the core of the evanescent waveguide fiber segment
10 and a substantially flat transverse-sectional shape near at least a portion of the core of the
11 evanescent waveguide fiber segment, the concave longitudinal-sectional shape of the
12 coupling portion of the cladding layer surface being adapted to receive and substantially
13 tangentially engage a whispering-gallery-mode optical resonator, and to enable evanescent
14 optical coupling between a whispering-gallery optical mode of the resonator and the
15 propagating optical mode in the evanescent waveguide fiber segment.
- 16 50. A fiber-optic waveguide as recited in Claim 42, wherein a thickness of the cladding layer
17 between the coupling portion of the cladding layer surface and the core of the evanescent
18 waveguide fiber segment yields a pre-determined level of optical loss of the evanescent
19 waveguide fiber segment.
- 20 51. A fiber-optic waveguide as recited in Claim 50, wherein the pre-determined optical loss
21 level is between about 0.1 dB and about 30 dB.
- 22 52. A fiber-optic waveguide as recited in Claim 50, wherein the pre-determined optical loss
23 level is between about 0.1 dB and about 10 dB.
- 24 53. A fiber-optic waveguide as recited in Claim 50, wherein the pre-determined optical loss
25 level is between about 0.1 dB and about 3 dB.
- 26 54. A fiber-optic waveguide as recited in Claim 50, wherein the pre-determined optical loss
27 level is between about 0.1 dB and about 1 dB.
- 28 55. A fiber-optic waveguide as recited in Claim 42, wherein a minimum distance between the
29 core of the evanescent waveguide fiber segment and the coupling portion of the cladding
30 layer surface is between about 0 μm and about 10 μm .

- 1 56. A fiber-optic waveguide as recited in Claim 55, wherein the core of the evanescent
2 waveguide fiber segment is partially exposed.
- 3 57. A fiber-optic waveguide as recited in Claim 42, wherein the adjacent fiber segments and
4 evanescent waveguide fiber segment are fabricated from polarization-maintaining optical
5 fiber, and each of said segments further comprises longitudinally extending stressor
6 elements disposed within the respective cladding layer in substantially opposing positions
7 about the respective core, the stressor elements of the evanescent waveguide segment
8 serving as transversely protruding passive alignment structures.
- 9 58. A fiber-optic waveguide as recited in Claim 57, wherein the passive alignment structures are
10 adapted to engage longitudinally adjacent fiber segments of a fiber-ring whispering-gallery-
11 mode optical resonator, thereby enabling reproducible substantially tangential engagement
12 of the evanescent waveguide fiber segment and a fiber-ring whispering-gallery-mode optical
13 resonator and enabling reproducible evanescent optical coupling between a whispering-
14 gallery optical mode of the fiber-ring resonator and the propagating optical mode of the
15 evanescent waveguide fiber segment.
- 16 59. A method for fabricating a resonant optical power control device incorporating a fiber-optic
17 waveguide fabricated by the method of any of Claims 1 through 40 or recited in any of
18 Claims 41 through 58, comprising the steps of:
19 positioning and securing the fiber-optic waveguide within a waveguide-alignment groove of
20 an alignment device; and
21 positioning and securing a whispering-gallery-mode optical resonator within a resonator-
22 alignment groove of the alignment device,
23 wherein:
24 the whispering-gallery-mode optical resonator is provided with an alignment member for
25 accurately positioning the resonator in the resonator-alignment groove;
26 the alignment device comprises a first alignment substrate, and the waveguide-alignment
27 groove and the resonator-alignment groove are provided on a first surface of the first
28 alignment substrate; and
29 the waveguide-alignment groove and the resonator-alignment groove of the alignment
30 device position the whispering-gallery-mode optical resonator in substantial tangential
31 engagement with the coupling portion of the cladding layer surface of the evanescent

1 waveguide fiber segment of the fiber-optic waveguide, thereby evanescently optically
2 coupling the resonator fiber segment and the fiber-optic waveguide.

3 60. A method for fabricating a resonant optical power control device as recited in Claim 59,
4 wherein the whispering-gallery-mode optical resonator comprises a fiber-ring of an optical
5 fiber, the fiber ring having a spatial differential of a physical property of the optical fiber
6 between a resonator segment of the optical fiber and longitudinally adjacent segments of the
7 optical fiber, thereby enabling substantial confinement by the resonator fiber segment of a
8 substantially resonant whispering-gallery optical mode propagating around the
9 circumference of the fiber at least partially within the resonator fiber segment, and at least
10 one of the adjacent fiber segments serves as the resonator alignment member.

11 61. A method for fabricating a resonant optical power control device as recited in Claim 59,
12 wherein the whispering-gallery-mode optical resonator comprises a micro-sphere connected
13 to a tapered portion of a resonator optical fiber, the resonator optical fiber substantially
14 coinciding with a symmetry axis of the micro-sphere and serving as the resonator alignment
15 member.

16 62. A method for fabricating a resonant optical power control device as recited in Claim 59,
17 wherein the resonator-alignment groove and the waveguide-alignment groove are
18 substantially perpendicular, and differ in depth so that the coupling portion of the cladding
19 layer surface of the evanescent waveguide fiber segment of fiber-optic waveguide is in
20 contact with the circumference of the whispering-gallery-mode optical resonator when the
21 fiber-optic waveguide and resonator alignment member are positioned within the
22 waveguide-alignment groove and the resonator-alignment groove, respectively.

23 63. A method for fabricating a resonant optical power control device as recited in Claim 59,
24 further comprising the step of sealing the alignment device, thereby isolating the fiber-optic
25 waveguide and the whispering-gallery-mode resonator from a use environment.

26 64. A method for fabricating a resonant optical power control device as recited in Claim 59,
27 wherein the resonator alignment member is provided with an alignment structure and the
28 resonator-alignment groove is provided with a corresponding alignment structure, thereby
29 enabling reproducible optical coupling of the whispering-gallery-mode optical resonator and
30 the coupling portion of the cladding layer surface of the evanescent waveguide fiber
31 segment of fiber-optic waveguide when the resonator alignment member and the
32 corresponding alignment structure of the resonator-alignment groove are engaged.

- 1 65. A method for fabricating a resonant optical power control device as recited in Claim 64,
2 wherein the resonator alignment member comprises a substantially annular circumferential
3 flange, and the corresponding alignment structure of the resonator-alignment groove
4 comprises a transverse groove for receiving the flange.
- 5 66. A method for fabricating a resonant optical power control device as recited in Claim 64,
6 wherein the corresponding alignment structure of the resonator-alignment groove comprises
7 an inwardly-protruding transverse flange, and the resonator alignment member comprises a
8 substantially circumferential groove for receiving the flange.
- 9 67. A method for fabricating a resonant optical power control device as recited in Claim 59,
10 further comprising the steps of positioning and securing a second optical waveguide within a
11 second waveguide alignment groove of the alignment device, wherein the second
12 waveguide-alignment groove and the resonator-alignment groove of the alignment device
13 position the resonator fiber segment in substantial tangential engagement with the second
14 optical waveguide, thereby evanescently optically coupling the whispering-gallery-mode
15 resonator and the second optical waveguide and enabling routing of optical power of the
16 propagating optical mode from the fiber-optic waveguide into the second optical waveguide.
- 17 68. A method of fabricating a resonant optical power control device as recited in Claim 67,
18 wherein the second optical waveguide comprises a second fiber-optic waveguide fabricated
19 by the method of any of Claims 1 through 40 or recited in any of Claims 41 through 58.
- 20 69. A method for fabricating a resonant optical power control device as recited in Claim 59,
21 wherein the whispering-gallery-mode resonator is provided with a modulator for controlling
22 optical properties of the whispering-gallery-mode resonator, and the alignment device is
23 provided with a modulator control element.
- 24 70. A method for fabricating a resonant optical power control device as recited in Claim 69,
25 wherein the modulator control element enables application of an electronic signal to the
26 modulator for controlled modulation of the optical properties of the whispering-gallery-
27 mode resonator.
- 28 71. A method for fabricating a resonant optical power control device as recited in Claim 69,
29 wherein the modulator control element enables application of an optical signal to the
30 modulator for controlled modulation of the optical properties of the whispering-gallery-
31 mode resonator.

- 1 72. A method for fabricating a resonant optical power control device as recited in Claim 69,
2 further comprising the step of sealing the alignment device, thereby isolating the fiber-optic
3 waveguide, resonator fiber segment, and modulator from a use environment.
- 4 73. A method for fabricating a resonant optical power control device as recited in Claim 69,
5 further comprising the step of positioning a secondary optical assembly on the alignment
6 device in substantial tangential engagement with the whispering-gallery-mode resonator,
7 thereby optically coupling the resonator and the secondary optical assembly and enabling
8 controlled modulation of optical coupling of the whispering-gallery-mode resonator and the
9 secondary optical assembly through the controlled modulation of the optical properties of
10 the whispering-gallery-mode resonator.
- 11 74. A method for fabricating a resonant optical power control device as recited in Claim 73,
12 wherein the secondary optical assembly comprises second fiber-optic waveguide.
- 13 75. A method for fabricating a resonant optical power control device as recited in Claim 73,
14 wherein the secondary optical assembly comprises a second whispering-gallery-mode
15 optical resonator.
- 16 76. A method for fabricating a resonant optical power control device as recited in Claim 73,
17 further comprising the step of sealing the alignment device, thereby isolating the fiber-optic
18 waveguide, resonator fiber segment, modulator, and secondary optical assembly from a use
19 environment.
- 20 77. A method for fabricating a resonant optical power control device as recited in Claim 59,
21 further comprising the steps of positioning and securing a modulator optical assembly on the
22 alignment device in substantial tangential engagement with the whispering-gallery-mode
23 resonator, thereby evanescently optically coupling the resonator and the modulator optical
24 assembly and enabling controlled modulation of optical coupling of the resonator and the
25 modulator optical assembly through the controlled modulation of the optical properties of
26 the modulator optical assembly.
- 27 78. A method for fabricating a resonant optical power control device as recited in Claim 77,
28 wherein the alignment device comprises a second alignment substrate having the modulator
29 optical assembly secured thereto and adapted to enable reproducible optical coupling of the
30 whispering-gallery-mode resonator and the modulator optical assembly.
- 31 79. A method for fabricating a resonant optical power control device as recited in Claim 78,
32 further comprising sealing the second alignment substrate onto the first alignment substrate,

1 thereby isolating the fiber-optic waveguide, whispering-gallery-mode resonator, and
2 modulator optical assembly from a use environment.

3 80. A method for fabricating a resonant optical power control device as recited in Claim 77,
4 wherein the alignment device is provided with a modulator control element for controlled
5 modulation of the optical properties of the modulator optical assembly.

6 81. A method for fabricating a resonant optical power control device as recited in Claim 80,
7 wherein the modulator control element enables application of an electronic signal to the
8 modulator optical assembly for controlled modulation of the optical properties of the
9 modulator optical assembly.

10 82. A method for fabricating a resonant optical power control device as recited in Claim 80,
11 wherein the modulator control element enables application of an optical signal to the
12 modulator optical assembly for controlled modulation of the optical properties of the
13 modulator optical assembly.

14 83. A method for fabricating a resonant optical power control device as recited in Claim 77,
15 wherein the modulator optical assembly comprises an optical loss modulator.

16 84. A method for fabricating a resonant optical power control device as recited in Claim 77,
17 wherein the modulator optical assembly comprises a non-linear optical device.

18 85. A method for fabricating a resonant optical power control device as recited in Claim 77,
19 wherein the modulator optical assembly comprises an electro-optic device.

20 86. A method for fabricating a resonant optical power control device as recited in Claim 77,
21 wherein the modulator optical assembly comprises an electro-absorptive device.

22 87. A method for fabricating a resonant optical power control device as recited in Claim 77,
23 wherein the modulator optical assembly comprises a semiconductor device.

24 88. A method for fabricating a resonant optical power control device as recited in Claim 77,
25 wherein the modulator optical assembly comprises a second whispering-gallery-mode
26 optical resonator.

27 89. A method for fabricating a resonant optical power control device as recited in Claim 77,
28 wherein the modulator optical assembly comprises a second fiber-optic waveguide.

29 90. A resonant optical power control device fabricated according to the method of any of Claims
30 59 through 89.

31 91. A resonant optical power control device, comprising:

1 an alignment device comprising a first alignment substrate having a waveguide-alignment
2 groove and a resonator-alignment groove on a first surface thereof;
3 a fiber-optic waveguide, fabricated by the method of any of Claims I through IB3 or recited
4 in any of Claims II through IIIF1, secured within the waveguide-alignment groove;
5 a whispering-gallery-mode optical resonator secured within the resonator-alignment groove,
6 wherein the waveguide-alignment groove and the resonator-alignment groove of the
7 alignment device position the resonator fiber segment in substantial tangential
8 engagement with the coupling portion of the cladding layer surface of the evanescent
9 waveguide fiber segment of the fiber-optic waveguide, thereby evanescently optically
10 coupling the resonator fiber segment and the fiber-optic waveguide.

11 92. A resonant optical power control device as recited in Claim 91, further incorporating the
12 limitations of any of Claims 59 through 89.
13